Abstract

Utilities are actively considering implementing distribution automation in their systems for the purpose of improving service reliability Reducing operational expenses is another aim One of the key features required for the success of the distribution automation is efficient algorithms for implementing the various automation functions One class of such algorithms are the feeder reconfiguration algorithms which are needed to find the restoration plans during outages due to faults and to modify the network state to improve the operating condition when abnormal states are encountered In particular in this thesis we develop new algorithms for service restoration load shedding load balancing and eliminating constraint violations in faulted/abnormally operating radial distribution systems

Two classes of algorithms have been developed for the service restoration problem In both the approaches two stages of the problem are considered In the first stage it is assumed that the healthy area is not to be reconfigured and restoration of fault affected area is attempted If this is unsuccessful some parts of the healthy area are also considered as affected in the second stage and the algorithms are used to restore as much load as possible

The first class of algorithms for service restoration successively restore zones in the fault affected area based on a notion of *electrical distance* The algorithms in the second class make use of the branch currents in a meshed state of the network for finding the restoration plan A novel technique of limiting the currents at the roots of the feeders to their ratings by employing current sources is proposed for handling capacity violations at the roots of the feeders while solving the network in meshed state

Load shedding is considered as an independent problem here A new load shedding algorithm is proposed to handle multiple current capacity and voltage drop violations simul taneously Current capacity violations are handled prior to handling voltage drop violations When several lines have capacity violations violations in lines closer to the leaf load points are eliminated first For each line with violations the zone to be shed is selected from the leaf zones supplied through that line Maximum voltage drop violation is used as a criterion for selecting leaf zones to be shed

Improving the system operational conditions is considered here for eliminating the viola tions of the system operational constraints and balancing the feeder loads In the method ology developed here both the violation removal and load balancing problems are posed as modified service restoration problems and are solved using the new service restoration algorithms with some modifications